

BEHAVIOR CHANGES ASSOCIATED WITH NEUTERING CATS AND DOGS

by

GAILYN L. DEES HOLLAND

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D.V.M., Kansas State University, 1966

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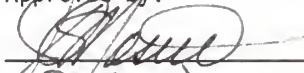
Department of Anatomy and Physiology

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Approved by:



Co-Major Professors

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INTRODUCTION

There has been a change in the philosophy that female cats and dogs should have one estrous cycle or a litter before being spayed, and that male cats and dogs should reach sexual maturity before being castrated.¹ Current recommendations are for pets to be neutered prior to sexual maturity for pet population control and for behavior reasons.²

Previous studies concerning age at the time of neutering and the effect on behavior have been retrospective studies.³⁻⁵ The present study deals with immediate information related to age at the time of neutering, reasons for neutering, and the impact of neutering on behavior. Questions were asked about neutering near the time of neutering, and the results of neutering evaluated by the owner to an interviewer 1 to 2 months after neutering.

In this study the term neutering refers to the process of spaying a female cat or dog or castrating a male cat or dog. Female cats reach puberty or sexual maturity at 5 to 7 months of age, while male cats reach sexual maturity at 8 to 12 months of age.⁶ Both female and male dogs are sexually mature at 6 to 12 months of age, with smaller breeds of female dogs reaching puberty earlier than larger breeds.⁶

Certain behaviors that can be affected by neutering are essentially "normal" behaviors of cats and dogs.⁷ However, they are abnormal, undesirable, or objectionable to owners and sometimes to non-owners of cats and dogs.⁷ Such behaviors include:

Sexual activity or mating refers to all the sexual behavior interactions with the opposite sex that may lead to breeding by female and male cats and dogs.^{8,9} In cats, sexual activity usually occurs at

night and may be annoying because of the vocal sounds emitted by the cats. Furthermore, the activity perpetuates the problem of overpopulation of both the canine and feline species.⁸

Intermale fighting, is a testosterone dependent aggressive behavior in which male cats fight with other male cats or male dogs fight with other male dogs.^{8,10} It is the only type of aggressive behavior altered by castration in cats and dogs.¹¹ Fighting between male cats frequently results in costly bite wounds and abscesses.⁸

Roaming refers to male cats and dogs repeatedly leaving home and spending periods of time, several hours or days, away from the resident territory.¹² Roaming may be a characteristic of the breed or may be related to sexual activities or fighting. It is particularly distressing to both the cat owners and to people on whose property the cat roams.⁸

Urine spraying by male cats is a territorial or scent-marking response to other male and female cats.¹³ It becomes very objectionable when performed around or inside the house in areas other than in the litter box.⁸ While urine is usually sprayed on vertical surfaces with the cat standing upright, it can also be sprayed from a squatting position onto a horizontal surface.¹⁴ For the purpose of this study, urine spraying by male and female cats refers to urination in the house in areas other than in the litter box. Male cats use urine spraying to communicate their presence to other male cats in surrounding areas.^{14,15} Female cats also spray urine in the house in areas other than the litter box.¹⁴ Intact female cats often spray during the breeding season to attract male cats.¹⁴ Spayed and intact female cats and also castrated male cats often spray when a household is overcrowded with cats or

because of some emotional arousal, anxiety, or resentment.^{13,14} Reasons for urinary spraying or scent-marking are not thought to be cognitive processes but rather are evolutionary or adaptive responses favoring survival of the feline species.¹⁴ Urine spraying is the most frequent behavior problem reported to veterinary medical practitioners.^{12,14,16}

Urine marking by dogs is a characteristic primarily of male dogs¹⁶ and refers in this study to urinating in the house as if the dog is marking his territory. Urine marking outside the house by the leg lift posture during and after puberty is done to mark vertical objects in the dog's environment or territory.¹⁷ Urine marking in the house is of much greater behavior importance and is affected by neutering.¹⁷

Mounting of other dogs or people's legs by male dogs is one aspect of male sexual behavior.⁴ It is most common in males but may occur in females¹² and usually begins as puppy sexual play behavior.¹² If puppies do not grow out of mounting people's legs or dogs as adults, or channel the behavior toward sexual activity to female dogs in heat, castration is indicated.¹²

Aggression has no uniformly acceptable definition.¹¹ Aggression is behavior that leads to damage or destruction of some target.¹¹ It is the most common and most serious behavior problem confronting the pet owner and the veterinary practitioner.¹¹ It is generally exemplified by dog and cat bites toward people and other dogs or cats.¹¹

The objectives of this study were to determine the number of cats and dogs neutered during a 6-month period at the Kansas State University Veterinary Medical Teaching Hospital and to determine the current age of each cat and dog when neutered as reported in a questionnaire. Further objectives were to determine the reasons why owners neuter their pets

and to determine the changes in behavior following the neutering of cats and dogs. Objectives were determined by use of a questionnaire sent to owners of all cats and dogs scheduled for neutering and returned for evaluation. It was anticipated that results would identify several reasons for neutering cats and dogs, give significant information for the development of population control measures related to sexual activity for cats and dogs, and correlate neutering with prevention or altering of "undesirable" behaviors of cats and dogs. It was further anticipated that results would establish a basis for advising owners about the possibility of success or failure of neutering in affecting certain behaviors of their cats and dogs.

LITERATURE REVIEW

AGE AT NEUTERING

One facet of the cat and dog overpopulation problem is the idea that a female animal should be allowed to have one estrous cycle or a litter before being spayed and a male animal should reach maturity before being castrated.¹ These ideas rested in tradition within the veterinary profession and within the doctrine for most all animal organizations for the welfare of animals.¹ In 1982, Lieberman¹ indicated that a change in the tradition was necessary, and he advocated the concept of early, 8 to 10 weeks of age, spaying and castrating of cats and dogs.

In 1980 a committee of the Canadian Veterinary Medical Association, considering the question of early neutering, did not make a recommendation for or against neutering prior to 4 months of age and continued to support the traditional practice of spaying and castrating after 5 to 6 months of age, as long as no evidence supported an earlier age.¹⁸

REASONS FOR NEUTERING

The main reason for "castrating" cats and dogs is to make them infertile and to stop mating behavior or sexual activity.² However, in clinical practice, cats and dogs are often "castrated" at the request of their owners to reduce or abolish so-called "objectionable behaviours" of mounting, urine scent marking, fighting, and roaming.²

In male cats the behavior patterns that can be eliminated or reduced by castration are sexual activity, intermale fighting, roaming, and urine spraying.⁸ In adult male dogs castration can alter

objectionable roaming, intermale fighting, urine marking in the house, and mounting of other dogs or people's legs.¹⁷ Except for roaming, castration is not as effective in altering canine behaviors as it is in feline behaviors.^{8,17}

BEHAVIOR CHANGES OF NEUTERING

Basic to understanding the behavior changes related to neutering is an understanding of what is responsible for male and female behavior. Prenatal and neonatal androgen determines early male and female differences, whereas the absence of prenatal and neonatal sex hormones determines female development and behavior.¹⁹⁻²² The differences between males and females are a function of a basic hormonal difference in the sexes.¹⁹⁻²² This comes about through differences in gonadal hormones in adults and through the action of certain hormones in the neonatal period.¹⁹⁻²² In the prenatal life and just after birth, the central nervous system undergoes a special type of development in regard to the neural substrate for the future expression of masculine or feminine behavior.¹⁹⁻²² Androgen secreted by the prenatal and/or neonatal male gonads has a masculinizing action on the brain resulting in the development of a masculine neural substrate which is later manifested in male behavior.¹⁹⁻²² The gonads in neonatal females during this critical period produce little to no significant amounts of any hormone, and the brain develops along feminine lines because of the absence of sex hormone.¹⁹⁻²² Young females exhibit female behavior characteristics, not because of neonatal estrogen or progesterone, but because of the absence of androgen.¹⁹⁻²² Experimental work with rats,

mice, guinea pigs, dogs, and monkeys has proved this concept of neonatal masculinization or feminization, and Hart believes it is true for cats, too.^{19,20}

Behavior differences between males and females are called sexually dimorphic behaviors.¹⁹⁻²² In male cats and dogs, copulation, intermale fighting, roaming, spraying, and mounting are more characteristic of males than females and are therefore sexually dimorphic behaviors, in that they have a stronger tendency or greater probability of occurring in one sex than another. Females exhibit behaviors related to estrus and maternal care. Females that are spayed, and some that are not, can and do occasionally exhibit aggression and spraying behaviors. Female kittens play less aggressively. Prior to puberty, male puppies play more aggressively and exhibit more mounting in playing than do female puppies. As they grow into adulthood, they lose interest in mounting other male dogs and start mounting female dogs in estrus. Some adult male dogs may continue to mount other males or even people's legs, a problem to owners.²¹

BEHAVIOR CHANGES OF SPAYING CATS AND DOGS

Ovariohysterectomy is performed in female cats to prevent estrus and estrus behavior; it alters or actually eliminates the gonadal hormones (estrogen and progesterone) which are imperative for cats to exhibit estrus periods of 4-10 days every 2-3 weeks if not mated. In the female cat, estrus behavior involves seeking out mates and emitting vocalizations and nervousness, while tomcats make their presence known by vocalizations, fights, and spraying urine.^{10,19}

Female dogs usually exhibit estrus twice a year by being more active, nervous, and attracting intact male dogs. Spaying, which eliminates the female gonadal hormones, stops estrus and estrus behavior, making the dog anestrus.²¹

BEHAVIOR CHANGES OF CASTRATION OF CATS AND DOGS

In respect to the behavior aspects of castration, castration does not erase the neural substrate of behaviors. Castration simply prevents testosterone from activating the neural substrate which developed earlier under the influences of neonatal gonadal androgen secretion. Behaviors that are eliminated by castration can and do occur occasionally in castrated cats and dogs as a reflection of the retention of the basic neural substrate for these behaviors, which are activated by changes in the environment such as a new cat, a visiting cat, or human visitors in the home.²⁰

Hart^{8,17} indicated the most common form of behavior therapy practiced in veterinary medicine is castration of the male cat and dog which results in basic changes in objectionable male behaviors. These included sexual activity, fighting, roaming, and urine spraying in cats and dogs, plus mounting of other dogs and of people's legs by dogs. These happen to be the sexual dimorphic behaviors that are most likely to be affected by castration.^{13,16}

In a retrospective study by Hart and Barrett⁵ involving 42 male cats castrated in adulthood, at 1 year old or older, after objectionable behaviors had begun, there was a rapid postoperative decline in fighting, roaming, and urine spraying in 53%, 56%, and 78% of the cases,

respectively. A gradual decline in these behaviors occurred in 35%, 38%, and 9% of the cases, respectively. No change occurred in the remaining cases. Age at time of castration was not related to the rate of decline. Often in the same cat, a rapid decline in one behavior occurred with only a gradual or no reduction in one or both of the other behaviors, denoting a range of individual differences in behavior changes after castration. The persistence of the androgen-dependent behavior patterns in some male castrated cats was not due to residual amounts of testosterone in the blood after castration, because plasma testosterone concentrations decline to zero or non-detectable levels within 6 hours after castration.⁵ Nor was the persistence of androgen-dependent behavior after castration attributed to androgen secretion by the adrenal gland.⁵ Castration prevents testosterone from activating the neural substrate but it does not erase the basic neural substrate of the androgen-dependent behaviors.²⁰ Persistent or renewed undesirable behavior, especially fighting and spraying, does occur sometimes in castrated cats and dogs; this results from the retention of the basic neural substrate for these behaviors and from certain intense environmental factors such as introducing a new cat to the neighborhood or house.⁸

In another survey of cats castrated prepuberally, between 6 and 10 months of age, Hart and Cooper³ found that prepuberal castration of cats was no more effective in preventing objectionable spraying or fighting than postpuberal castration was in eliminating the behaviors after they started. Prepuberal castration also had no influence on the prevalence of spraying or fighting later in life. They did find that castrated

male cats fought and sprayed more than spayed female cats. Furthermore, neutered male cats living with female cat housemates fought and sprayed more than did neutered male cats living with a male cat housemate.

Non-sexual aggression is not affected by castration.⁸ Unlike intermale fighting, predatory or hunting and fear-induced aggression is not reduced by castration. Castrated cats do not tend to become fat and lazy.⁸

Prior sexual experience promoted the retention of sexual behavior in male cats after castration. Rosenblatt and Aronson²³ found a decline in normal sexual behavior, including intromissions and mounting, related to the amount of prior sexual or copulatory experience after castration of male cats. Groups of male cats allowed maximal sexual experience prior to castration performed intromissions for as long as 1 week to 2½ years after castration and mounting for as long as 4½ years after castration at 10 to 19 months of age. Groups of male cats allowed no copulatory activity or sexual activity until achievement of 1 interrupted mount prior to castration either exhibited no sexual activity or mounting with few intromissions, for several months after castration.

In a retrospective study by Hopkins *et al*⁴ involving 42 male adult dogs, the objectionable male behaviors including intermale fighting or intermale aggression, roaming, urine marking in the house, and mounting of other dogs or of people's legs were altered by castration. Roaming was reduced in 90% of the dogs. The other behaviors declined in 50% to 70% of the dogs. Age of the dog at castration did not correlate with the rate of decline in the behaviors or with the effectiveness of castration. This study also revealed that some dogs became calmer and

more affectionate after castration. Dogs did not become fat and inactive after castration. Individual differences between dogs in response to castration reflected the individual genetic make-up of the dogs and environmental circumstances.¹⁷ Studies by LeBoeuf²⁴ indicated that prepuberal and postpuberal castrated dogs behaved similarly in sexual behavior and urine marking postures.

LeBoeuf²⁴ reported that prepuberal castration of male dogs did not significantly reduce mounting during development or sexual responsiveness of adult dogs to estrus female dogs for as long as several years after castration, but it did prevent complete copulations. Neither did prepuberal castration decrease aggressive behavior or fighting in developing puppies and adult dogs. LeBoeuf²⁴ also cited that castration reduces aggression in many animals including lizards, turtles, mice, rats, monkeys, and birds.

BEHAVIOR CHANGES OF NEUTERING OTHER ANIMALS

A retrospective study of 140 horses by Line *et al*²⁵ revealed that of 96 geldings castrated prepuberally, before 2 years of age, 20% to 30% exhibited stallion-like sexual behavior and aggression toward horses and 5% were aggressive toward people. The occurrence of these problem behaviors was not significantly different from the occurrence of sexual behavior and aggression in 45 geldings castrated as stallions, over 3 years of age. In those cases where castration was performed therapeutically to eliminate sexual and aggressive behavior in stallions, in which the behaviors had become objectionable, castration was effective on sexual behavior and aggression toward people in 60% to 70% of the horses and on aggression toward other horses in 40% of the horses.

Hart and Barrett⁵ reported that fighting declined within 2-4 weeks after castration of male mice, rats, and gerbils. A decline in scent marking was noted in adult male hamsters and gerbils within 2 weeks after castration.

Prepuberal ovariectomy of female Tamarin monkeys retarded the development of the scent gland and resulted in decreased scent marking and in decreased aggressive behavior.²⁶

In a study involving 8 male goats, Hart and Jones²⁷ found that except for a significant decrease in frequency of ejaculatory responses, within a week after castration, male goats retained their sexual activity for almost a year after castration.

Zussman et al²⁸ reported that when decreased sexual response occurred in human females after ovario-hysterectomies, hormonal change and anatomic changes, removal of the cervix-uterus, may have been etiologic factors.

Experiments by Lisk and Heimann²⁹ revealed sexually experienced hamsters exhibited longer retention of sexual or copulatory behavior after castration than did sexually inexperienced hamsters. There was a gradual disappearance of the male copulatory patterns, mounting and intromissions, within a few weeks of castration. This also occurred in other rodents such as rats and mice.

Kiley³⁰ noted that testosterone was considered responsible for male-like behavior and an increase in aggression in male mice, rats, and voles. Castration reduced fighting in red deer and mice and rabbits. Kiley³⁰ also indicated one of the main reasons for castration of farm animals was to reduce male aggression and to make males easier to

handle, including stallions, bulls, boars, and rams. However, environmental conditions can be significant in inducing aggression in these animals.

METHODS

NUMBER OF CATS AND DOGS NEUTERED

A listing of all of the cats and dogs scheduled to be neutered was obtained over a 6-month period extending from October 1, 1984, through March 31, 1985, at the Kansas State University Veterinary Medical Teaching Hospital. The owner's name, address, and telephone number, were obtained from the receiving desk's appointment book. A questionnaire (Appendix I) was mailed to each owner prior to the date of surgery. Owners were asked to return the questionnaire by mail or to bring it to the hospital receiving desk at the time of admission of the cat or dog.

The questionnaire consisted of two parts or pages. Part 1 was concerned with the age, sex, breed, housing, and presence of other pets. Part 2 dealt with the reasons for having the pet neutered, sexual history, and behaviors.

AGE OF CATS AND DOGS NEUTERED

Only the cats and dogs that were actually neutered and whose owners answered the questions and returned the questionnaires, were included in the study to determine the age at neutering, to relate with the reasons why owners neuter their pets, and to clarify the behavior changes of such neutering.

REASONS FOR NEUTERING

The question "Why are you having your dog or cat neutered?" was asked to establish the reasons that owners wanted their cat or dog

neutered. Questions number 2 through 10 of part 2 of the questionnaire related to the behavior of the cats and dogs being neutered. Question 7 "Has your female cat urinated in the house in places other than in the litter box?" and question 10 "Has your dog or cat bitten or shown aggression toward other animals?" related to female cats. Question 10 related to female dogs. Question 8 "Has your male cat been fighting, roaming, and urine spraying?" and question 10 related to male cats. Question 9 "Has your male dog been fighting, roaming, urine marking, or mounting dogs or people's legs?" and question 10 related to male dogs. Questions 7 through 10 all related to possible additional reasons for neutering.

The questions were designed to reveal specific behaviors that owners found in their pets, as well as reasons for neutering, but not specified as such by the owners in question number 1. If a behavior was noted as a reason for neutering by the owner in answer to question number 1, and the owners marked the same behavior in questions 7, 8, 9, and/or 10, the behavior was counted only once as a reason for neutering, with priority given to the answers to question number 1.

After analysis of the reasons for neutering, the questionnaires were divided into categories for animal species and sex that had no behavior problems versus those that had behavior problems prior to neutering. Behavior problems in cats and dogs are essentially normal behaviors that owners consider abnormal, undesirable, or objectionable problems in their pets.

BEHAVIOR CHANGES OF NEUTERING

Owners of cats and dogs exhibiting behaviors considered abnormal, objectional, undesirable, or problems prior to neutering, were telephoned 1 to 2 months after the cat or dog was neutered. The owners were asked about the specific behaviors they had written in answer to question number 1, on the questionnaires as a reason for neutering and about any other behaviors they indicated their pet exhibited in question 7, 8, 9, and/or 10, on the questionnaire. First they were asked if neutering had changed the behavior they wanted changed, if it was noted in question number 1; then they were asked how the behavior had changed, whether it was eliminated, reduced, or unchanged. The owners who marked yes for behaviors in questions 7, 8, 9, and/or 10, were asked whether those behaviors had changed after neutering. Throughout the telephone interview, behaviors were discussed as behaviors by the interviewer, so as not to lead the owners or to suggest a behavior problem to them until it was established whether the owners interpreted the behavior as a "normal" behavior of the pet, or a behavior that was a problem to the owners.

The owners were then asked if the behavior was a problem to them, if they had not already declared this fact on the questionnaire, and the possible relationship of the behavior (problem) to the reason for neutering their pet. The 33 behaviors of 23 male cats that were desired to be "prevented" by the owners were discussed. Any change in an owners view about the behavior of their cat or dog was also discussed.

Various statistical analyses were applied to the data. The normal deviate Z test was applied to the percent of cats and dogs in different age groups at neutering in Table 4, owners reasons for neutering in

Table 5, and the incidence of reported pre-neutering behavior problems in Table 6 to determine statistically significant and non significant proportions and numbers. A paired sample chi square test was applied to the behavior changes that occurred due to neutering (Tables 7,8,9,10).

RESULTS

NUMBER OF CATS AND DOGS NEUTERED

Two hundred twenty-three (136 cats and 87 dogs) were neutered during the 6-month period extending from October 1, 1984, through March 31, 1985 (Table 1). The total hospital admission for all reasons including spaying, castration, tail docking, and declawing, plus treatment of sick cats and dogs and routine immunization during the same period included 586 cats and 917 dogs for a total of 1503 cats and dogs. The figures were compared in Table 1 to three other 6-month time periods including October 1, 1983, through March 31, 1984; April 1, 1984, through September 30, 1984; and April 1, 1984, through September 30, 1985. While different numbers were noted in the four time periods, the totals were very similar, suggesting that the period of this study was representative of the average flow of patients.

Completed questionnaires were obtained on 64 female and 52 male cats and on 32 female and 17 male dogs totalling 165 cats and dogs (Table 2). Thus, 70.0 percent of the cats and 30.0 percent of the dogs undergoing neutering were represented in the analysis.

AGE OF CATS AND DOGS NEUTERED

The age at the time of neutering of each of the 165 cats and dogs included in the questionnaire study were recorded (Table 3). A majority of the male cats 76.92% and female cats 68.75% and dogs 59.37% were 6 months to 1 year of age when neutered, while an almost equal number of male dogs were castrated at 6 mo - 1 yr 29.41%, 1 yr - 1½ yr 23.52%, 1½ yr - 2 yr 11.76%, and 2 years and older 35.29% (Table 4).

The number of female cats and dogs spayed and male cats castrated between the ages of 6 months to 1 year were statistically significantly different from the other age percents from 1-1½ yr, 1½-2 yr, and 2 yr and older (Table 4). However, there was no statistically significant percent of male dogs castrated at any particular age. A greater percent of male dogs 35.29%, were castrated at 2 years of age and older than were female dogs 18.75%, or male cats 9.61%, and female cats 10.93%.

REASONS FOR NEUTERING

In answer to: "Why are you having your dog or cat neutered?", owners gave a variety of reasons in Table 5. The reasons as given by owners in their own words were: to prevent unwanted kittens, prevent puppies and heat, prevent heat, prevent breeding, prevent estrus, control pet population, or prevent overpopulation of animals, do not want kittens, cannot afford more kittens, avoid noisy heat, stop him from spraying in the house, to stop his roaming, to keep him home, stop fighting between cats, to stop her from urinating in areas in the house other than the litter box, and to prevent fighting, roaming, or spraying.

The reasons for neutering were assigned to one of several groups including prevention of kittens and puppies and/or prevent estrus; prevent breeding or sexual activity; prevent, eliminate, or reduce behavior problems; no answer; and other answers. Other answers included: make a better pet, calm him or her down, hip problems, and retained testicle. Prevent, eliminate, or reduce behavior problems

indicated that by neutering their cat or dog, owners wanted to correct or prevent a behavior which they considered abnormal, undesirable, objectionable, or a problem.

Where owners indicated more than one reason for having their cat or dog neutered in question 1, all reasons were considered. The percentages in Table 5 are based on the number of answers given by the owners to question 1; therefore, the sum of the percents did not always add up to 100 because owners sometimes gave more than one reason for neutering. Often the answers to question 3 "Did you decide to spay your female dog or cat to prevent estrus behavior and estrous cycling or heat or season?" and question 4 "Did you decide to spay or castrate your pet to prevent having puppies or kittens?" were coincidentally written by the owners in answering question 1, but in the owners wording.

Sixty-one percent of the reasons for spaying cats and fifty percent of the reasons for spaying dogs were "to prevent kittens and puppies", while eighty-five percent of the reasons for castrating cats and forty-one percent of the reasons for castrating dogs were "to prevent, eliminate, or reduce behavior problems". There was a statistically significant greater percentage of reasons given by owners for spaying and castrating cats as compared to spaying and castrating dogs (Table 5).

Data gathered from the 165 questionnaires from questions 1 through 10, revealed male dogs had 82.4 percent and male cats had 75.0 percent behavior problems or undesirable behaviors prior to neutering compared to female dogs which had 9.4 percent and female cats with 39.1 percent behavior problems or undesirable behaviors prior to neutering. Conversely, the animals with no behavior problems or undesirable behaviors

prior to neutering were female dogs 90.6 percent, female cats 60.9 percent, male cats 25.0 percent and male dogs 17.6 percent. Thus, cat and dog spays had a lower percentage of undesirable behaviors prior to neutering, while cat and dog castrations had a greater percentage of undesirable behaviors (Table 6).

The total number and percentages of answers for questions 2 through 11 on the questionnaire are recorded on a sample questionnaire in Appendix II.

BEHAVIOR CHANGES OF NEUTERING

Results of the telephone interviews conducted between 1 and 2 months following surgery clarified the behaviors reported by the owners of the cats and dogs prior to neutering. Owners either admitted that the essentially normal, yet undesirable or objectionable behaviors, were problems to them and they hoped that neutering would change the 81 behavior problems; or they anticipated, in the case of 23 male cat owners, that the 33 behaviors might become problems and they wanted to "prevent" them. One to two months after these 23 male cats were castrated, during the telephone interview, owners indicated that the objectionable behavior they had anticipated or had not anticipated had not developed at that time.

Behaviors that owners wanted to prevent, eliminate, or reduce by neutering were: spraying and aggression in female cats; fighting, roaming, urine spraying in the house, and aggression in male cats; aggression in female dogs; and fighting, roaming, urine marking in the house, mounting, and aggression in male dogs (Tables 7,8,9,10).

Urine spraying by female cats was significantly eliminated in 87.5% of 16 cats and was reduced in 6.2% of 16 cats after spaying. Urine spraying by male cats was significantly eliminated in 77.7% of cats and was reduced in 22.2% of 9 cats after castration. Roaming was significantly eliminated in 55.5% of 9 male cats and in 100% of 5 male dogs by castration. Roaming was reduced in 44.4% of 9 male cats following castration. Mounting of other dogs by male dogs was significantly eliminated by 100% of 6 male dogs after castration of the dogs. All of the percentage values for those behaviors that were eliminated were statistically significant.

No significant change was noted in intermale fighting by cats and by dogs, urine marking by male dogs, mounting of people's legs by male dogs, and aggression of all pets to people and to animals. Intermale fighting was eliminated in 28.5% of 7 male cats and reduced in 71.4% of 7 male cats after castration. Intermale fighting was also eliminated in 33.3% of 3 male dogs and reduced in 66.6% of 3 male dogs after castration. Urine marking was eliminated in 75.0% of 4 male dogs and reduced in 25.0% of 4 male dogs after castration. Mounting of people's legs by male dogs was eliminated in one male dog after castration. Aggression by 62% of 21 pets was eliminated or reduced after neutering. Spaying of one cat failed to change spraying behavior and 8 pets remained aggressive after neutering.

In 3 cases, cessation of a behavior was apparently a result of environmental changes rather than neutering. One owner threw out the rug a female cat was spraying on and the cat stopped spraying. Another owner reported that changing food resulted in cessation of spraying. A third owner concluded the fighting in her male cat was just playing.

Table 1

Comparative Data for Admission of Cats and Dogs
to the KSU Veterinary Medical Teaching Hospital

	Oct 1, 1983- March 31, 1984	Apr 1, 1984- Sept 30, 1984	Oct 1, 1984- <u>March 31, 1985</u>	Apr 1, 1985- Sept 30, 1985
Cat Spays	61	44	75	52
Cat Castr.	$\frac{47}{108}$	$\frac{39}{83}$	$\frac{61}{136}$	$\frac{31}{153}$
Dog Spays	84	76	57	68
Dog Castr.	$\frac{42}{126}$	$\frac{23}{99}$	$\frac{30}{87}$	$\frac{32}{100}$
Total No. Spays & Castr.	234	182	223	253
Total Cats	646	645	586	699
Total Dogs	1319	1234	917	935
Total Cats & Dogs	1965	1879	1503	1634

Table 2

Results of Owner Questionnaires Regarding
Number of Cats and Dogs Neutered each Month

	<u>No. Cats</u>		<u>No. Dogs</u>		
	Female	Male	Female	Male	
<u>Month</u>					
October	13	10	6	1	
November	17	7	5	2	
December	6	8	4	2	
January	7	9	5	3	
February	15	10	9	5	
March	6	8	3	4	
n	64	52	32	17	Total = 165

Table 3

Results of Owner Questionnaires Regarding
Age and Number of Cats and Dogs at Time of Neutering

	<u>No. Cats</u>		<u>No. Dogs</u>		
	Female	Male	Female	Male	
<u>Age</u>					
Unknown	2	0	0	0	
0-6 mo	0	1	1	0	
6 mo - 1 yr	44	40	19	5	
1 yr - 1½ yr	6	4	4	4	
1½ yr - 2 yr	5	2	2	2	
2 yr +	7	5	6	6	
n	64	52	32	17	Total = 165

Table 4
Percent of Cats and Dogs in Different Age Groups
at the Time of Neutering as Reported in Owner Questionnaires

	<u>% Cats</u>				<u>% Dogs</u>			
	Female		Male		Female		Male	
	%	SE*	%	SE	%	SE	%	SE
<u>Age</u>								
Unknown	3.12 ± 2.2 ^{*b}		0		0		0	
0-6 mo	0		1.92 ± 1.9 ^b		3.12 ± 3.1 ^b		0	
6 mo - 1 yr	68.75 ± 5.8 ^a		76.92 ± 5.8 ^a		59.37 ± 8.7 ^a		29.41 ± 11.05 ^b	
1 yr - 1½ yr	9.37 ± 3.6 ^b		7.69 ± 3.7 ^b		12.50 ± 5.8 ^b		23.52 ± 10.3 ^b	
1½ yr - 2 yr	7.81 ± 3.4 ^b		3.84 ± 2.7 ^b		6.25 ± 4.3 ^b		11.76 ± 7.8 ^b	
2 yr +	10.93 ± 3.9 ^b		9.61 ± 4.1 ^b		18.75 ± 6.9 ^b		35.29 ± 11.6 ^b	

* Percent ± Standard Error

^a Significant proportions ($P < .05$)

^b Proportions within a column with common superscripts are not significantly different ($P < .05$)

Table 5
Owners Primary Reasons for Neutering Their Pets *

<u>Reasons</u>	Female		Male		Female		Male	
	Cat Spay		Cat Cast.		Dog Spay		Dog Cast.	
	No.	%	No.	%	No.	%	No.	%
Prevent kittens & puppies	(39)	60.9 ^a	(11)	21.1	(16)	50.0 ^b	(3)	17.6
Prevent estrus	(9)	14.1	0	0	(2)	6.3	0	0
Prevent kittens & puppies & estrus	(8)	12.5	0	0	(11)	34.4	0	0
Prevent breeding or sexual activity	0	0	(8)	15.4	0	0	(2)	11.8
Prevent, eliminate, or reduce behavior problems	(2)	3.1	44	84.6 ^a	0	0	(7)	41.2 ^b
No answer	(4)	6.2	0	0	(3)	9.4	(1)	5.9
Other	(2)	3.1	(3)	5.8	(2)	6.3	(4)	23.5
n	64		52		32		17	
Total %		99.9		126.9		106.4		100.0

* Compiled from responses to questionnaire question 1:
Why did you have your dog or cat neutered?

^a Significant proportions ($P < .05$)

^b Proportions not significant ($P < .05$)

Table 6

Incidence of Reported Behavior Problems Prior to Neutering

<u>Animal Category</u>	<u>No.</u>	<u>%</u>	<u>SE</u>	<u>95% CI</u>
Cat Spays (n=64)				
No Behavior Problems	39	60.9 ± 6.0		6 & 18
Behavior Problems	25	39.1		
Cat Castrations (n=52)				
No Behavior Problems	13	25.0 ± 6.0		6 & 18
Behavior Problems	39	75.0 ^a		
Dog Spays (n=32)				
No Behavior Problems	29	90.6 ± 5.1		5.1 ± 15.3
Behavior Problems	3	9.4		
Dog Castrations (n=17)				
No Behavior Problems	3	17.6 ± 9.2		9.2 ± 27.6
Behavior Problems	14	82.4 ^a		

^a Significant proportions (P < .05)

Table 7

Behaviors of FEMALE CATS Eliminated or Reduced after Spaying

Behaviors	No. of Cats	Behavior Eliminated	Behavior Reduced	Behavior Unchanged
Urine Spraying	16	14 [*]	1	1
Aggression	7	5	0	2

Table 8

Behaviors of MALE CATS Eliminated or Reduced after Castration

Behaviors	No. of Cats	Behavior Eliminated	Behavior Reduced	Behavior Unchanged
Intermale Fighting	7	2	5	
Roaming	9	5 ^{**}	4	
Urine Spraying	9	7 [*]	2	
Aggression	7		4	3

* 5% level of significance ($P < .05$)

** 10% level of significance ($P < .10$)

Table 9

Behaviors of FEMALE DOGS Eliminated or Reduced after Spaying

Behaviors	No. of Dogs	Behavior Eliminated	Behavior Reduced	Behavior Unchanged
Aggression	3	0	1	2

Table 10

Behaviors of MALE DOGS Eliminated or Reduced after Castration

Behaviors	No. of Dogs	Behavior Eliminated	Behavior Reduced	Behavior Unchanged
Intermale Fighting	3	1	2	
Roaming	5	5 ^{**}		
Urine Marking	4	3	1	
Mounting Other Dogs	6	6 [*]		
Mounting People's Legs	1	1		
Aggression	4	1	2	1

* 5% level of significance ($P < .05$)

** 10% level of significance ($P < .10$)

DISCUSSION

NUMBER OF CATS AND DOGS NEUTERED

A total of 136 cats and 87 dogs neutered over one 6-month period at the Kansas State University Veterinary Medical Teaching Hospital was not significantly different from the numbers neutered over 3 other 6-month periods surrounding the 6-month period involved in this study. Questionnaires concerned with behavior and desired behavior changes following neutering were completed on 116 cats and 49 dogs.

AGE AT NEUTERING

The 68.7 percent female and 76.9 percent male cats and 59.3 percent female dogs neutered between 6 months and 1 year, was statistically significant, indicating that a statistically significant number of owners were having their female and male cats and female dogs neutered prior to or near the age of sexual maturity. All of the male dogs were neutered from 6 months to 8 years of age. The most common type of behavior therapy practiced in veterinary medicine is castration, and all male domestic animals, except the dog, are routinely castrated pre-puberally.⁸ When serious behavior problems are noted in male dogs, castration is a frequent therapeutic measure.¹⁷

REASON FOR NEUTERING

In this study preventing sexual activity, estrus, and therefore kittens and puppies were the main reasons for owners having their female cats at 60.9% reasons and dogs at 50.0% reasons, spayed. Preventing, eliminating, or reducing behavior problems was the main reason for

having their male cats at 84.6% reasons and dogs at 41.2% reasons, castrated. These results indicate that owners of female cats and dogs were perhaps more aware of population control, while owners of male cats and dogs were more often aware of behavior problems of their pets when considering neutering. In a retrospective study involving the castration of adult male dogs, the reason for castration was population control in 10.6% of 42 dogs. Additionally, 88% of the 42 adult dogs were castrated in an attempt to change one or more objectionable behavior.⁴

BEHAVIOR EFFECTS OF NEUTERING

Results of this study, relative to the behavior effects of neutering on 81 behavior problems in cats and dogs revealed that 61.7 percent of these behavior problems in cats and dogs were eliminated after neutering, 27.1 percent were reduced, and 11.1 percent were unchanged.

Castration significantly eliminated urine spraying in 77.7% and roaming in 55.5% of male cats, and roaming in 100% and mounting of other dogs in 100% of male dogs. Urine marking was eliminated in 75% and reduced in 25% of male dogs, and mounting of people's legs was eliminated in one male dog.

In a retrospective study by Hart & Barrett⁵ urine spraying was reduced in 87%, roaming in 94%, and fighting in 88% of the 42 male cats castrated as adults. In a retrospective study by Hopkins *et al*⁴ roaming was reduced in 90%, while urine marking, intermale fighting, and mounting was reduced in 50% to 65% of the 42 male dogs castrated as adults.

Results of castration on intermale fighting in both male cats and male dogs was not as expected compared to the results of the studies by Hart and Barrett and by Hopkins. The difference was in the 28.5% elimination of intermale fighting in male cats and 33.3% in male dogs after castration in the present study. Reduction of the behavior was 71.4% in male cats in the present study compared to 88% in Hart and Barrett's study in male cats and reduction of the behavior was 66.6% in male dogs in the present study compared to 50% to 65% in Hopkins study in male dogs. Intermale fighting is the type of aggression largely prevented or eliminated by castration,¹⁰ but not in the present study, perhaps due to a confusion by the owners while answering the question 10 on aggression.

In the present study, aggression toward animals and people, as reported from question 10 on the questionnaire, was not affected by neutering. This aggression included territorial, fear-induced, pain-induced, play aggression, redirected aggression, and attack aggression of people. These aggressive behaviors are not affected by neutering.¹³

Spaying significantly eliminated spraying behavior in 87.5% of 16 female cats exhibiting spraying behavior prior to neutering. Castration eliminated spraying behavior in 77% of the male cats in the present study and in 87% of those in a study by Hart & Barrett.⁵

It is generally believed that castration of male cats before puberty largely prevents fighting, roaming, and urine spraying.^{3,5,20} In the present study, owners of 23 male cats without behavior problems identified 33 behaviors, either fighting, roaming, and/or spraying, they hoped to prevent by castration. Twelve or 52.1% of the cats were

between 4 months and 7½ months of age, were considered not sexually mature, and were castrated prepuberally. Eleven or 47.8% of the cats were between 8 months and 19 months of age, were considered sexually mature, and were castrated postpuberally. None of the cats, whether prepuberally or postpuberally castrated, had exhibited fighting, roaming, or spraying behaviors prior to castration or within the one to two months after castration. Perhaps postpuberal castration would be equally as effective in preventing behavior problems which have not started at the time of castration.

The results of the present study provide information about the effects of neutering on certain behaviors in cats and dogs. The information is important to veterinarians in understanding recommendations for the age to neuter cats and dogs and to advise owners about the potential of neutering for preventing, eliminating, and reducing certain unwanted behaviors in their pet.

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APPENDIX I

The Veterinary Hospital
and
The Department of Anatomy and Physiology
Kansas State University
Manhattan, Kansas 66506

Dear Client:

I, Dr. Gailyn Holland, am interested in the behavior of animals. I am presently investigating the behavioral effects of neutering dogs and cats.

Before you bring your dog or cat to the KSU Veterinary Hospital on _____ to be spayed or castrated, would you please help me by answering the following questions:

Owner's name: _____

Address: _____

Telephone no.: _____

Kind of pet: _____ dog _____ cat

Age of pet: _____

Breed of pet: _____

Name of pet: _____

Housing of pet: _____ indoor _____ outdoor

Other pets in your home: _____ dogs _____ cats _____ none

Would you also answer the questions on the attached questionnaire and mail both sheets of questions to me in the addressed, postage-paid enclosed envelope. Or you may bring the forms to the admitting desk of the KSU Veterinary Hospital when you bring your dog or cat to be neutered.

Thank you.

Gailyn Holland, D.V.M.

Questionnaire:

Would you please answer the following questions that apply to the pet that you are having neutered.

1. Why are you having your dog or cat neutered?

2. Has your dog or cat had any sexual experience? _____ yes _____ no
3. Did you decide to spay your female dog or cat to prevent estrous behavior and estrous cycling (heat or season)? _____ yes _____ no
4. Did you decide to spay or castrate your pet to prevent having puppies or kittens? _____ yes _____ no
5. Has your female dog been in heat? _____ yes _____ no
If so, how many times? _____
If so, when was she in heat last? _____
6. Has your female cat been in heat? _____ yes _____ no
If so, how many times? _____
If so, did she exhibit vocal and nervous behavior and attract vocalizing male cats? _____ yes _____ no
7. Has your female cat urinated in the house in places other than in the litter box? _____ yes _____ no
8. Has your male cat been --
(1) Fighting with other male cats? _____ yes _____ no
(2) Roaming or spending periods of time away from home? _____ yes _____ no
(3) Urinating in the house in areas other than in the litter box? _____ yes _____ no
(4) Marking his territory by urinating in areas outside the house? _____ yes _____ no
9. Has your male dog been --
(1) Fighting with other male dogs? _____ yes _____ no
(2) Roaming or spending periods of time away from home? _____ yes _____ no
(3) Urinating in the house as if marking his territory? _____ yes _____ no
(4) Urinating outdoors as if marking his territory? _____ yes _____ no
(5) Mounting other dogs? _____ yes _____ no
(6) Mounting people? _____ yes _____ no
10. Has your dog or cat bitten or shown aggression toward other animals? _____ yes _____ no
If yes, specify -- _____ dog
_____ cat
_____ human
_____ sex of above
11. If your dog or cat shows any tendency toward aggression or fighting, would you be receptive to an interview and/or questionnaire concerning this behavioral problem? _____ yes _____ no

APPENDIX II

Summary of Data from Page 2 of 165 Questionnaires

Questionnaire:

Would you please answer the following questions that apply to the pet that you are having neutered.

1. Why are you having your dog or cat neutered?

2. Has your dog or cat had any sexual experience? ☐ yes ☐ no

	<u>Cats</u>				<u>Dogs</u>			
	<u>Female</u>		<u>Male</u>		<u>Female</u>		<u>Male</u>	
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>
yes	(16)	27.6	(5)	10.6	(5)	17.2	(2)	13.3
no	(42)	72.4	(42)	89.4	(24)	82.8	(13)	86.7
n	58		47		29		15	
no Ans	(6)	9.4	(5)	9.6	(3)	9.4	(2)	11.8
n	64		52		32		17	

3. Did you decide to spay your female dog or cat to prevent estrous behavior and estrous cycling (heat or season)? ☐ yes ☐ no

	<u>Female Cats</u>		<u>Male Cats</u>	
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>
yes	(52)	100.0	(25)	83.3
no	(10)	19.2	(5)	16.7
n	52		30	
no Ans	(2)	3.1	(2)	6.3
n	64		32	

4. Did you decide to spay or castrate your pet to prevent having puppies or kittens? _____ yes _____ no

	<u>Cats</u>				<u>Dogs</u>			
	<u>Female</u>		<u>Male</u>		<u>Female</u>		<u>Male</u>	
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>
yes	(59)	92.2	(30)	62.5	(31)	100.0	(8)	53.3
no	(5)	7.8	(18)	37.5	(0)	0	(7)	46.7
n	64		48		31		15	
no Ans	(0)	0	(8)	15.4	(1)	3.1	(2)	11.8
n	64		52		32		17	

5. Has your female dog been in heat? _____ yes _____ no

	<u>n</u>	<u>%</u>		<u>n</u>	<u>%</u>
yes	(15)	50.0			
no	(15)	50.0	no Ans	(2)	6.3
n	30		n	32	

If so, how many times?

	<u>n</u>	<u>%</u>		<u>n</u>	<u>%</u>
1 time	(9)	60.0			
2 times	(1)	6.7			
3 times	(3)	20.0			
4 times	(1)	6.7			
5+ times	(1)	6.7	no Ans	(0)	0
n	15		n	0	

6. Has your female cat been in heat? _____ yes _____ no

	<u>n</u>	<u>%</u>
yes	(25)	39.7
no	(32)	50.8
n	63	

	<u>n</u>	<u>%</u>
no Ans	(1)	1.0
n	1	

If so, how many times?

	<u>n</u>	<u>%</u>
1 time	(9)	40.9
2 times	(3)	13.6
3 times	(1)	4.5
4 times	(0)	0
5+ times	(9)	40.9
n	22	

	<u>n</u>	<u>%</u>
no Ans	(3)	12.0
n	25	

If so, did she exhibit vocal and nervous behavior and attract vocalizing male cats?

	<u>n</u>	<u>%</u>
yes	(10)	45.5
no	(12)	54.5
n	22	

	<u>n</u>	<u>%</u>
no Ans	(3)	12.0
n	25	

7. Has your female cat urinated in the house in places other than in the litter box? _____ yes _____ no

	<u>n</u>	<u>%</u>
yes	(18)	28.1
no	(46)	71.9
n	64	

8. Has your male cat been --

- 1.
- Fighting
- with other male cats? ____ yes ____ no

	<u>n</u>	<u>%</u>		<u>n</u>	<u>%</u>
yes	(7)	14.6			
no	(41)	85.4	no Ans	(4)	7.7
n	48		n	52	

- 2.
- Roaming
- or spending periods of time away from home?
-
- ____ yes ____ no

	<u>n</u>	<u>%</u>		<u>n</u>	<u>%</u>
yes	(9)	18.0			
no	(41)	82.0	no Ans	(2)	3.8
n	50		n	52	

- 3.
- Urinating
- in the house in areas other than the litter box?
-
- Spaying
- ____ yes ____ no

	<u>n</u>	<u>%</u>		<u>n</u>	<u>%</u>
yes	(9)	17.6			
no	(42)	82.4	no Ans	(1)	1.9
n	51		n	52	

- 4.
- Marking
- his territory by urinating in areas outside the house?
-
- ____ yes ____ no

	<u>n</u>	<u>%</u>		<u>n</u>	<u>%</u>
yes	(6)	14.6			
no	(35)	85.4	no Ans	(11)	21.2
n	41		n	52	

9. Has your male dog been --

- 1.
- Fighting
- with other male dogs? ____ yes ____ no

	<u>n</u>	<u>%</u>
yes	(3)	17.6

no	(14)	82.4
----	------	------

n	17
---	----

no Ans	<u>n</u>	<u>%</u>
	(0)	0

n	0
---	---

- 2.
- Roaming
- or spending periods of time away from home?
-
- ____ yes ____ no

	<u>n</u>	<u>%</u>
yes	(5)	29.4

no	(12)	70.6
----	------	------

n	17
---	----

no Ans	<u>n</u>	<u>%</u>
	(0)	0

n	0
---	---

- 3.
- Urinating
- in the house as if marking his territory?
-
- Spaying
- ____ yes ____ no

	<u>n</u>	<u>%</u>
yes	(5)	31.3

no	(11)	68.8
----	------	------

n	16
---	----

no Ans	<u>n</u>	<u>%</u>
	(1)	5.9

n	17
---	----

- 4.
- Urinating
- outdoors as if marking his territory?
-
- ____ yes ____ no

	<u>n</u>	<u>%</u>
yes	(14)	82.4

no	(3)	17.6
----	-----	------

n	17
---	----

no Ans	<u>n</u>	<u>%</u>
	(0)	0

n	0
---	---

5. Mounting other dogs? ____ yes ____ no

	<u>n</u>	<u>%</u>		<u>n</u>	<u>%</u>
yes	(6)	37.5			
no	(10)	62.5	no Ans	(1)	5.9
n	16		n	17	

6. Mounting people? ____ yes ____ no

	<u>n</u>	<u>%</u>		<u>n</u>	<u>%</u>
yes	(5)	29.4			
no	(12)	70.6	no Ans	(0)	0
n	17		n	0	

10. Has your dog or cat bitten or shown aggression toward other animals? ____ yes ____ no

If yes, specify -- ____ dog ____ cat ____ human ____ sex of above

	<u>Cats</u>				<u>Dogs</u>			
	<u>Female</u>		<u>Male</u>		<u>Female</u>		<u>Male</u>	
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>
yes	(12)	19.4	(12)	23.5	(3)	9.4	(4)	23.5
no	(50)	80.6	(39)	76.5	(29)	90.6	(13)	76.5
n	62		51		32		17	
no Ans	(2)	3.1	(1)	1.9	(0)	0	(0)	0
n	64		52		32		17	

11. If your dog or cat shows any tendency toward aggression or fighting, would you be receptive to an interview and/or questionnaire concerning this behavioral problem? ____ yes ____ no

BEHAVIOR CHANGES ASSOCIATED WITH NEUTERING CATS AND DOGS

by

GAILYN L. DEES HOLLAND

B.S., Kansas State University, 1964

D.V.M., Kansas State University, 1966

AN ABSTRACT OF A MASTER'S THESIS

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A study to evaluate the impact of neutering on cats and dogs was conducted over a 6-month period at the Kansas State University Veterinary Medical Teaching Hospital.

Names and addresses of owners of cats and dogs scheduled for neutering were obtained via the appointment and check-in book at the hospital. The number of cats and dogs spayed and castrated in the hospital during the 6-month study was 223. The ages of the 165 cats and dogs whose owners answered a questionnaire about reasons for neutering and about their pet's behavior before and after neutering ranged from 5 months of age to 8 years of age. A statistically significant percent ranging from 60% to 77% of the female cats and dogs and male cats were neutered between the ages of 6 months and 1 year.

Owners primary reasons for neutering were the prevention of more kittens and puppies in 60% of cat and 50% of dog spays and changing behavior problems in 84% of cat and 41% of dog castrations.

Statistical values indicated behavior changes were significantly eliminated by neutering in 77% of male cats and 88% of female cats with histories of spraying prior to neutering, in 55% of male cats and 100% of male dogs with histories of roaming prior to neutering, and in 100% of male dogs with a history of mounting other dogs prior to neutering. Aggression by both sexes of cats and dogs, intermale fighting by male cats and dogs, and mounting of people's legs by male dogs were reduced by neutering.

The results of the study demonstrate that owners can rely on certain behavior problems being prevented, eliminated, or reduced by neutering. Veterinarians can use the results of this study to better advise owners of cats and dogs about the probable success or failure of neutering in affecting certain behaviors of their pets.